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1	2	61	62
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Precursor Lesions in Exposed Populations as
Indicators of Occupational Cancer Risk --
Rate, Inhalation Ingestion

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2	61	62
	31	
	32	

Annals of the New York Academy of Sciences
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Brief Summary

2	10	61	62
		61	
		62	
		63	
		64	

ABSTRACT:

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PRECURSOR LESIONS IN EXPOSED POPULATIONS AS INDICATORS OF OCCUPATIONAL CANCER RISK

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Nowadays, one more and more must face the problem of working population groups who are exposed to a carcinogenic risk, namely, workers exposed to agents known to be carcinogenic both on the basis of experimental bioassays and on the basis of epidemiologic investigations; workers exposed to agents known to be carcinogens on experimental systems, though not yet epidemiologically proven to have an effect on humans; and workers exposed to agents of recent production, about which there is no valid experimental study or epidemiologic research yet available.

We all agree that exposed occupational populations should undergo careful periodical medical examinations that must be as specific as possible and whose results should be correlated to occupational exposure.

The aim of medical control, in the field of occupational oncogenesis, is chiefly to detect and to characterize, early and precisely, any precancerous or cancerous changes or any other change correlated directly or indirectly to exposure to a carcinogen.

The data obtained from such examinations are important from several points of view:

They may provide information for epidemiologic investigations that are aimed at detecting possible oncogenic factors in the occupational environment.

They may add weight to the results of experimental carcinogenicity bioassays on agents already produced and/or used in industry.

They may provide information on the degree of the risk in the factory as a whole and in each section of it.

They may be used to very directly verify whether planned or claimed measures of protection are valid and sufficient.

The early detection of precancerous lesions presents the possibility of introducing protective measures, which, in turn, may lower the incidence or delay the appearance of occupational tumors.

The methods used in these examinations should be as specific as possible, sensitive, precise, easily repeatable, and harmless for the workers examined.

They will vary, of course, depending on the type of carcinogens and on the organs more likely to be affected, that is, the target organs.

At the same time, it must be noted that the value of early detection of already established occupational tumors has been and is overemphasized. In fact, it is now known that, often in an exposed population, occupational tumors may arise simultaneously in different organs, and in the same organs they are often multicentric. Well-established examples of multicentric tumors are, for instance, liver angiosarcomas in vinyl chloride workers, occupational pulmonary tumors, asbestos-induced mesotheliomas, and tumors of the urinary tract caused

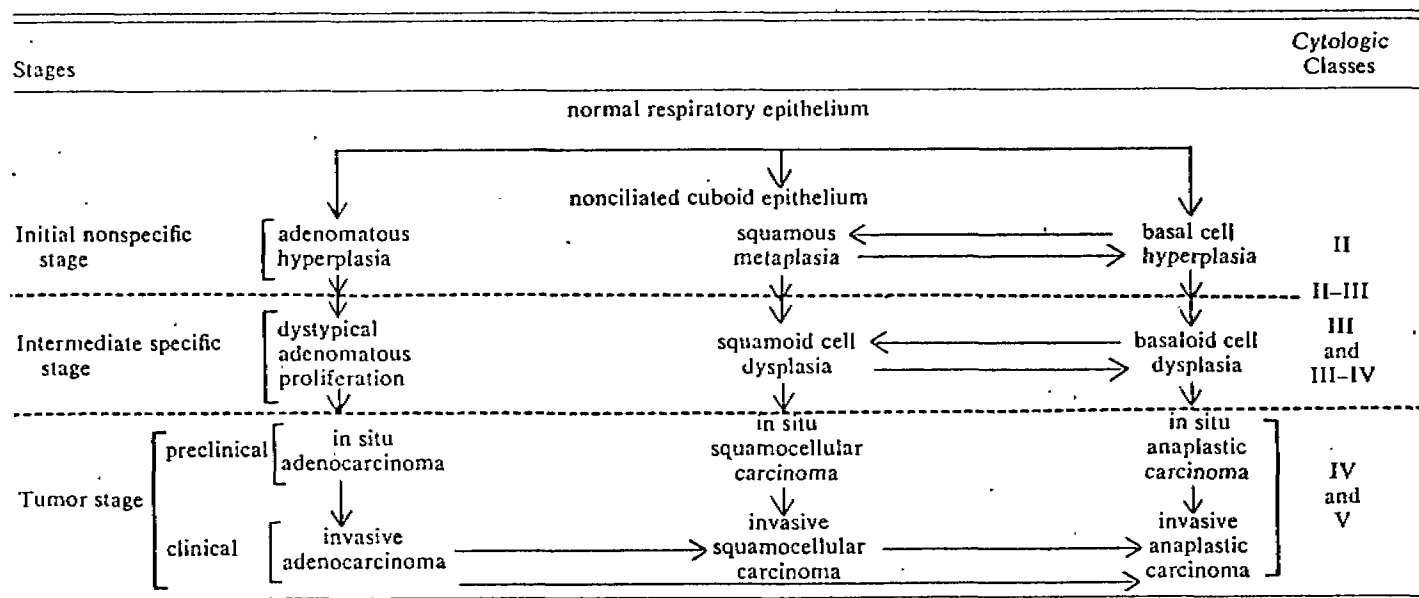
TABLE 1
SEQUENCES OF LOCAL CHANGES IN THE GENESIS OF THE VARIOUS HISTOTYPES OF PULMONARY CARCINOMAS

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Stages

TABLE 1

SEQUENCES OF LOCAL CHANGES IN THE GENESIS OF THE VARIOUS HISTOTYPES OF PULMONARY CARCINOMAS



by aromatic amines. Investigations performed in our Institute on the last kind of occupational cancer have shown that in dyestuff workers with bladder tumors, dysplastic and cancerous foci may be detected from the renal pelvis to the urethra. In such a situation, very little, of course, can be done to cure these individuals. Our position, therefore, is in sharp contrast to those who claim to "protect" (!) workers exposed to carcinogenic risk by early detection of tumors.

With the aim of contributing to the identification of oncogenic factors, to the epidemiologic investigation of occupational cancer risk, to monitoring the efficacy of protective measures, and to the detection of early tumor precursors, we are conducting at our Institute several projects of periodic mass examinations of occupational groups at risk.

Two examples of monitoring occupational risk by the detection of precursor lesions are reported here. The method used is cytologic examination.

The first example is of occupational groups who are known or suspected of being at risk of developing pulmonary cancer.

Many of the steps in the histogenesis of pulmonary cancers are now known. The possible sequence of local changes in lung carcinogenesis with reference to cancer histotypes is shown in TABLE 1.

The distribution of the various cytologic indices determined by sputum examination has been studied among workers of the chemical industry. Three different groups have been examined: workers in the chromium industry exposed to bichromates and chromium pigments, workers of the vinyl chloride-polyvinyl chloride (VC-PVC) industry exposed to the monomer, and workers of different chemical factories not directly involved in the production or use of known carcinogens. Heavy smokers (20 or more cigarettes per day for more than 10 years, or 15-20 cigarettes per day for more than 15 years) not working in chemical industries were chosen as controls.

The results are reported in TABLE 2. The incidence of the abnormal classes II-III, III, and III-IV among chromium and VC-PVC workers is much higher than expected, even when compared with populations of heavy smokers. Of particular importance is the increased incidence of the more advanced classes among chromium and VC-PVC workers, and also among workers of the chemical industry in general.

TABLE 2

FREQUENCY OF CELLULAR CHANGES IN THE RESPIRATORY TRACT AMONG WORKERS OF CHROMIUM, VC-PVC, AND THE GENERAL CHEMICAL INDUSTRY, DETECTED BY SPUTUM CYTOLOGY

Workers		Cytologic Classes (Papanicolaou)					
Occupation	No.	I	II	II-III	III and III-IV	IV	V
Chromium industry	116	—	62	24	30	—	—
	(100%)		(53.4%)	(20.7%)	(25.9%)		
VC-PVC industry	267	75	138	38	16	—	—
	(100%)	(28.1%)	(51.7%)	(14.2%)	(6%)		
Chemical industry (in general)	371	112	196	57	6	—	—
	(100%)	(30.2%)	(52.8%)	(15.4%)	(1.6%)		
Control (heavy smokers)	1000	335	556	103	6	—	—
	(100%)	(33.5%)	(55.6%)	(10.3%)	(0.6%)		

FREQUENCY OF CEL
EXPOSED TO AROMA

Factory	No. of Wor Under Con
A	232
B	159
C	40
D	41
Total	472

The 116 workers to a group of 200, a the past few years. involved was closed c

The second exan group of 472 worke amines and therefore

The incidence of of class III or more. the last result may l secutive cytologic ex on symptomless peo class III and over th

It should be poi among whom in the upper urinary tract

The two examp sented, indicate bot network of preventi deal with past or pr to be carinogens or assessed.

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TABLE 3

FREQUENCY OF CELLULAR ATYPIAS IN THE URINARY TRACT AMONG WORKERS EXPOSED TO AROMATIC AMINES IN FOUR NORTH ITALIAN DYESTUFF FACTORIES, DETECTED BY URINE CYTOLOGY

Factory	No. of Workers Under Control	Cytologic Classes (Papanicolaou)							
		I	I-II	II	II-III	III	III-IV	IV	V
A	232	48	46	114	14	7	1	1	1
B	159	58	20	49	25	5	1	1	—
C	40	11	8	7	3	8	1	2	—
D	41	16	15	9	1	—	—	—	—
Total	472	133	89	179	43	20	3	4	1

The 116 workers exposed to chromium compounds examined by us belong to a group of 200, among whom 21 cases of lung carcinomas were detected in the past few years. Incidentally, following our finding, the section of the factory involved was closed down.

The second example is the cytologic examination of urinary sediments in a group of 472 workers from four Italian dyestuff factories exposed to aromatic amines and therefore at risk for tumors of the urinary tract.

The incidence of classes II-III and over was surprisingly high, with 28 cases of class III or more, equivalent to about 60% (TABLE 3). The significance of the last result may be appreciated when it is realized that among 60,000 consecutive cytologic examinations of urinary sediments performed in our Institute on symptomless people from the general population, we found an incidence of class III and over that approached 1%.

It should be pointed out that these 472 workers belong to a group of 1449, among whom in the past years 189 cases of tumors of the bladder and of the upper urinary tract were detected.

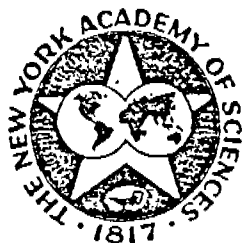
The two examples reported, among the many that could have been presented, indicate both the value and the need for such examinations in the network of preventive measures to be undertaken when, unfortunately, we must deal with past or present occupational exposures to agents known or suspected to be carcinogens or to agents whose effects on man have not yet been properly assessed.

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